

ON THE TAXONOMIC VALUES OF THE WING MEMBRANES AND OF
THE TERMINAL PHALANGES OF THE DIGITS IN
THE CHEIROPTERA.

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When a bat with outstretched wing is held between the eye of the observer and a bright light the membranes are seen to be traversed by numbers of lines. Many of these are delicate trabeculæ of connective tissue,—in some instances continuous with the fascia of the forearm, or palm, in others with the capsules of the joints. They can be seen in some examples passing obliquely from the third metacarpal bone over the palmar surface of the fourth to the membrane between the fourth and fifth bones. The wing membrane is strengthened at the free margin by several trabeculæ which pass from the tibia at a point near the ankle to the second digit of the fifth finger. The course of vessels can be traced, as, for example, from the elbow forward and downward on the wing membrane, and on the inter-femoral membrane. Tendons can be seen, as the tendon of the biceps at the elbow, that of the occipito-pollicalis, that of the flexor carpi-radialis at the angle between the radius and the fifth metacarpal bone, that of the abductor minimi digiti (which often permits light to pass beneath it), and that of the palmar interosseous along the first phalanx of the fifth finger. Separate fascicles of the panniculus can be detected either unattached (as is the rule) or continuous with some of the fibrous trabeculæ already mentioned, or united at one end to bone.

Prominent among the markings are those of the nerves. The following have been recognized: branches of the intercostal nerves, of the superficial branches of the lumbar plexus* and of the intercosto-humeral, the internal cutaneous, the external cutaneous and the median nerves.

A study of these details has led me to form a good opinion of their availability in describing families, genera and (sometimes) species.

When a specimen which is held for a moment before a moderately bright light can be assigned in the majority of instances to its true

* Since the superficial branches of the intercostal nerves are homologous with those of the lumbar plexus they are all named for convenience the intercostals,—the crural line is the lowest of the series.

position time is saved and the animal preserved intact. As may be anticipated the value of these characters varies in different groups. But even when they are not sufficiently trenchant to serve for the identification of species or genera, they always indicate affinities, and enable the observer, independently of other aids, to narrow the surmises of recognition to a limited field.

The details are of restricted use in studies of the dried skins. All statements (with three exceptions) must be considered as applicable to alcoholics only.

I have found it convenient to employ a number of names for the subdivision of the dermal expanse. Those which are now used for the first time are italicized.

The membrane which extends from the sides of the trunk to include the anterior extremity is the wing membrane ("bat-wing," patagium).

The membrane between the legs is the interfemoral membrane (uropatagium).

The wing-membrane above the arm and forearm is the *prebrachium* (antebrachial membrane, propatagium).

The wing-membrane below the arm and forearm would become antithetically the postbrachium. But since the postbrachium could not be separated from the sides of the trunk and the legs it has been found necessary to discard it.

The part of the wing-membrane lying between the body, the humerus, the lower extremity and a hypothetical line drawn downward from the elbow and intersecting the free margin of the membrane, is the *endopatagium*. (Pl. X, fig. 1.)

The boundary at the elbow is often fixed by the vertical terminal branch of the intercosto-humeral line. The subordinate lines (probably platysmal in origin) in the endopatagium incline obliquely either toward the humerus or the trunk.

The part of the wing-membrane which is limited by the line at the elbow as above given, by the forearm, and the fifth metacarpal bone and phalanges, is the *mesopatagium*.* Within the mesopatagium the subordinate lines incline either toward the forearm or the manus.

The part of the wing-membrane limited to the manus becomes the *ectopatagium* (dactylo-patagium). The subdivisions of the ecto-

* The endopatagium and mesopatagium are together the same as plagio-patagium of Kolenati. (Beitr. z. Naturgesch. der Europ. Chir. Dresden, 1857.)

patagium are the first, second, third and fourth *interspaces*. These are named from the pollex toward the quintus. The series of bones which is embraced in the metacarpal and phalangeal lines being conspicuous in the bat, it is desirable to possess a name in referring to each series taken as a whole. The name digit will be used for the rod of segments embracing the metacarpal element. The nerve which appears at the anterior margin of a digit becomes *predigital*, and that of the posterior margin, *postdigital*.

The radio-metacarpal angle is the space defined by the angle of union of the forearm and the metacarpus.

The cartilaginous tip to the terminal bony phalanx respectively of the third, fourth and fifth fingers will receive the name of the third phalanx when three phalanges, and of the fourth phalanx when four phalanges are present.¹ The shapes of the terminal phalanges are of interest and some of these will be described.

I have examined a sufficient number of genera to suggest that an account of the markings of the wing-membranes, and of the shapes of the terminal phalanges enter into all discriminating studies. Inasmuch as the account includes descriptions of these parts in the North American bats the validity of the characters can be at once put to the test.

Artibeus perspicillatus.

The prebrachium with free margin occupied with a band 1mm. wide which apparently represents the tendon of the occipito-pollical—is muscle.

Intercostal markings conspicuous, four in number. The lowest is the largest and extends as far as the ankle. The oblique band, which extends upward and outward from the ankle on the mesopatagium in many genera, is absent in *Artibeus*. The intercosto-humeral line is conspicuous and extends to a point in vertical line with the elbow. The vertical platysmal fascicles are about 30 in number. The internal cutaneous system extends as far as end of the fifth finger. It is composed of three divisions, a vertical, oblique and a horizontal.²

The fourth interspace is provided with a faintly marked longitu-

¹ Kolenati first identified the tips as phalanges.

² The horizontal line represents the main trunk of the nerve, and the vertical and oblique lines the branches. "Inferior vertical" and "superior oblique" (terms which are occasionally used in the notes) are amplifications of the last-named terms.

dinal line, which begins at a point 22mm. from carpus and extends to a point 10mm. from the free margin of the membrane. The predigital nerve appears at the middle of the fifth metacarpal bone, and is larger than the postdigital which appears at the metacarpo-phalangeal joint of the third finger.

The third interspace is provided with a longitudinal line as in the fourth. This line extends from near the palm and reaches to within 10mm. of the free margin of the membrane. A nerve appears at the metacarpo-phalangeal joint of the fourth finger and lies obliquely across the lower part of the interspace.

The fourth phalanx of the third digit is sickle-shaped, the membrane extending from its tip; that of the fourth digit is of the shape of an inverted T; that of the fifth finger is triangular, the angle, which is directed toward the body, being prolonged.

Centurio senex.

Centurio is remarkable for the system of unpigmented spaces in the mesopatagium near the radio-metacarpal angle and in having the fourth interspace entirely occupied by these transversely arranged spaces. No nerves appear in any position of this interspace. In other respects the membranes are as in other Phyllostomidae.

Carollia.

In *Carollia* the lines are essentially of the same type as in *Artibeus* and need not be described.

Vampyrus spectrum.

The prebrachium with several obliquely placed lines which pass upward and forward from the forearm.

In this form the longitudinal lines of the third and fourth interspaces are much the same as in *Artibeus*. The predigital nerve of the fourth interspace is small and appears directly above the metacarpo-phalangeal joint. A well-defined tendon is seen lying parallel to the first digit of the fifth finger. The postdigital arises from the metacarpo-phalangeal joint of the fourth finger. An homologous arrangement of nerves is seen in the third interspace. In the interfemoral membrane an oblique line (pubo-tibial) extends from pelvis to the middle of the tibia and an axial line in the center the entire length of the interfemoral membrane. A line passes from the knee obliquely downward and outward and is apparently one of the intercostal series; but there is none passing upward and outward from

the tibia. Of the terminal digits that of the third is the same as in *Artibeus*; that of the fourth is triangular with the long angle directed toward the body; and that of the fifth is much the same but the angle is so far produced that the form of the triangle is scarcely discernible.

Phyllostoma hastatum. (Pl. x, fig. 1.)

Prebrachium. An oblique line crosses prebrachium near the wrist, a branch of a line and which runs parallel to the radius.

Endopatagium, with two intercostal lines, and a number of oblique secondary (muscle) lines. The intercosto-humeral line appears at the middle of the humerus. Its main branch reaches the line of the elbow and thence passes downward to near the free margin. The internal cutaneous line with a vertical line near the elbow, and a single large two-partite superior oblique line. The main line goes nearly to the end of the fifth metacarpal bone, one branch going toward the metacarpo-phalangeal joint. An oblique raised line extends on the membrane from the end of the muscle-mass. The fibers continuous with this line can be traced nearly as far as the end of the fifth digit. A distinct line begins at the tip of the fifth finger and passes upward in a straight line. The terminal branches of these two lines in part mingle.

The fourth interspace presents six lines in the predigital series. Of these one is a raised oblique line from the muscle-mass; a second answers to the nerve commonly found in the order. The postdigital lines are two in number,—one from about each joint.

The third interspace with a large predigital which extends obliquely across the membrane to the end of the third digit. The postdigital is small and unimportant. The longitudinal line is present in both the fourth and third interspaces.

The interfemoral membrane is marked by four vertical lines; the pubo-tibial is absent.

Schizostoma sp ?

The endopatagium is occupied by four vertical lines which are forked above. The lowest (crural) line of the intercostal series alone seen. The intercosto-humeral line absent. Mesopatagium. The internal cutaneous line with a large vertical at the elbow. A single large superior oblique is present which reaches the fifth metacarpal bone. The main line reaches the end of the fifth finger.

¹ When a line is absent it is implied that it is not seen, and not that, by dissection, it cannot be demonstrated.

The ectopatagium exhibits five predigital,—the largest appears at the distal third of the fifth metacarpal bone, and apparently is the same as the single predigital of some other species of *Phyllonotomidae*. The longitudinal line in the fourth and third interspaces conspicuous. No pubotibial line in the interfemoral membrane.

Glossophaga soricina.

The endopatagium without intercostal line present save the lowest or crural. The intercosto-humeral a mere unbranched line near the elbow.

The mesopatagium without a superior oblique line. No fold is seen at the muscle-mass of the fifth metacarpal bone or line along the fifth digit. In the fourth interspace a single predigital appears at the distal fifth of the fifth metacarpal element. In a second specimen a second predigital appeared at the metacarpo-phalangeal joint.

Vampyrops lineatus.

The endopatagium with four intercostals,—the lower being branched. No oblique muscle lines. The intercosto-humeral line is faintly expressed, barely discernible. The remaining lines as in *Artibeus*. An oblique line from the muscle-mass. This line is continuous with one extending parallel to the digit to end at the terminal of phalanx. There are eleven secondary (muscle) lines in mesopatagium.

Vampyrops helleri.

Much the same as in *V. lineatus*. The line from the fifth metacarpal bone in the mesopatagium is not raised at the muscle-mass and is everywhere indistinct.

Desmodus rufus.

The prebrachium with the greater part with depressed tendon so that the space which is inclosed between the tendon and the free margin is crescentic.

Endopatagium. The intercostals inconspicuous, eleven (?) counted. The lowest of these is the longest. The intercosto-humeral is inconspicuous and ends at a point proximal to the elbow.

The internal cutaneous line of the mesopatagium with conspicuous vertical branch in advance of the elbow and with two oblique superior branches. The line ends 1mm. sonad of the end of the fifth digit. The secondary lines are about eighteen in number and approach the radio-metacarpal angle.

The fourth interspace. The predigital appears at the middle of the fifth metacarpal bone. The postdigital is curved and appears just proximal to the end of the fourth metacarpal bone.

The third interspace. The predigital from the fourth metacarpophalangeal joint.

A well-defined longitudinal line is seen in the third interspace but none in the fourth.

The fourth phalanx of the third finger is flexible as in *Artibeus*. The fourth phalanx of the fourth finger is minute, scarcely visible, axial; that of the fifth finger is membranous, and deflected somad.

Diphylla ecaudata (dried skin).

The endopatagium with intercostals six in number distinct, the lowest is the longest. The intercosto-humeral arises near the axilla and does not reach the elbow.

The internal cutaneous apparently without vertical or oblique branches. A distinct oblique fold, as in *Noctilio*, passes downward from the muscle-mass of the fifth metacarpal bone. Secondary lines about fifteen in number, but do not approach the fifth digit or the radio-metacarpal angle.

The only line seen in the ectopatagium is the oblique predigital of the fourth interspace. It appears at the middle of the fifth metacarpal bone. The terminal digits apparently much the same as in *Desmodus*.

Brachyphylla cavernarum.

Prebrachium ample, volant entire length. A thickened border is seen but no markings.

The lines of the endopatagium, which appear to represent the intercostals, four in number. A great number of more delicate lines, which appear to be connective-tissue trabeculae with nerve-endings, are also seen. The intercosto-humeral line is first seen at the middle of the humerus. It forks once and ends at the margin of the membrane on a line with the elbow.

The internal cutaneous line sends a vertical branch downward at the elbow, and a second, half-way along the course of the line. Two superior oblique lines are seen. Fifteen vertical lines, most of which transect the main line, can be counted.

The fourth interspace with predigital line from the distal third of the fifth metacarpal bone. The postdigital from the metacarpophalangeal joint of the fourth digit. The longitudinal line confined

to the space between these lines. The third interspace with nerves as is so generally the case with the Phyllostomidæ, viz., the predigital from the metacarpo-phalangeal joint and the postdigital from the first interphalangeal. The longitudinal line is conspicuous the entire length of the interspace.

The terminal phalanges are much the same as in *Artibeus* but that of the fourth digit is less lobate.

A caudo-tibial line conspicuous in the interfemoral membrane.¹

Noctilio leporinus.

The prebrachium without distinctive markings. The thickening in the tendon of occipito-pollical muscle as long as the thumb and lies on the radius.

Intercostal lines small inconspicuous. The intercosto-humeral small unbranched, does not reach farther than elbow. The internal cutaneous system of two divisions, the vertical being absent. The oblique line with long horizontal primal branch. The abrupt transition of the oblique fibres from the horizontal line is the same as in *Atalapha*. Thirteen vertical lines traverse the mesopatagium. An elevated oblique fold of skin passes downward and backward from the palmar aspect of fourth and fifth metacarpal bones.

In the fourth interspace the digital nerves appear at the middle of metacarpals. The postdigital is seen running parallel to the fourth metacarpal bone before being distributed to the membrane. A tendon is seen on either side of the fifth rod at its distal third. At the first interphalangeal joint of the third and fourth fingers a nerve appears on the opposed sides of the third interspace and each is distributed separately to the membrane.

Interfemoral membrane scarcely translucent in portion carrying the tail and is traversed by a line without subdivisions on either side of the tail. The infracaudal portion is much thinner than the caudal and is traversed by an oblique line much divided on either side of the terminal point of the tail. Respecting the differences in translucency of the interfemoral membrane it is seen that a similar contrast is seen in the wing-membrane, viz., in the endopatagial and mesopatagial tracts. These portions in *Molossus* and *Atalapha* are apt to be more or less hairy.

The sickle-shaped terminal phalanx of the third finger is free; that of fourth finger is thread-like, sigmoid, and inclosed; and that of the fifth digit acicular, deflected toward body and is also inclosed.

¹ *Brachyphylla* has been described as tailless. In a number of examples recently examined a tail measuring 3mm. was detected.

Emballonura semicaudata.

The prebrachium with middle third of margin thin ; answering to it is a concave line about 2 mm. distant in the center but reaching margin of membrane at the ends of the middle third ; passing downward from the crescent thus defined are four oblique lines. The prebrachium as it joins the shoulder is slightly thickened.

The endopatagium with indistinct lines, the general disposition of which are the same as in *Miniopteris*. The lowest line appears to arise from the knee. The intercosto-humeral line quite the same as in *Miniopteris*.

The internal-cutaneous much the same as in this genus, but is less developed, the terminal branches being smaller.

A tendon lies on endopatagium forming a concave line along side of the first digit of the fifth finger. The fourth interspace shows a single nerve, viz., the predigital which appears at the middle of the muscle-mass at distal end of the fifth metacarpal bone and passes obliquely downward and forward across the entire interspace. In the third interspace a nerve appears from the opposed metacarpophalangeal joints, as in *Vampyrus*, *Noctilio*, etc.

The lines in the interfemoral membrane as in *Noctilio*, with the exception that the pelvic line extends to the free margin instead of to the middle of the tibia.

The terminal phalanx of the third finger sickle-shaped not cartilaginous ; the membrane is attached to its tip, and is without pigment in the space which answers to a line uniting the two ends of the phalanx. The terminal phalanx of the fourth finger is acicular, the extreme tip alone projecting from the membrane ; that of the fifth finger is half the length of the last named, presents a free tip, and is entirely free on the outer (pollical) side.

Saccopterya leptura.

Prebrachium is abruptly narrowed at the distal end of the muscle-mass of the forearm ; thence it gradually widens to the thumb. The margin is crescentic, and almost equals the rest of the membrane in area. The membrane is traversed by a single line apparently from the external-cutaneous nerve.

The intercostals eleven in number. The intercosto-humeral rudimentary scarcely reaching to the elbow. Internal-cutaneous line with a sharply curved branch descending from near elbow. The superior oblique single. The main line extends obliquely toward the end of the fifth digit.

The predigital line of the fourth interspace appears near proximal end of the fifth digit. It crosses obliquely the interspace to the end of the fourth digit. It sends a branch which runs along the fifth digit. In a second example two predigital nerves were present.

Interfemoral membrane with faintly marked caudo-crural lines which extend from the tail to the tibia at the ankle.

***Miniopterus schreibersii*.**

The prebrachium with a broad marginal band (tendon of occipitopollical?) but without oblique lines to the delicate line extending concentric to the marginal band.

Lines of endopatagium six in number, conspicuous. Intercostohumeral line originates near the axilla and reaches the free margin of the wing-membrane at a point below the elbow. The internal-cutaneous system composed of the oblique or main fibers only, and ends abruptly after a long horizontal branch, as in *Noctilio*. It is distributed quite to the tip of the fifth finger. Vertical lines beneath main line fibers abundant, at least seventeen in number, crowded toward the end of the line. The oblique line from the ankle conspicuous and joins the intercosto-humeral.

The fourth interspace shows the predigital nerve extending parallel to the fifth metacarpal bone to its distal third and is thence deflected obliquely downward and forward to the end of the fourth digit. The postdigital often absent; when present it is small and inconspicuous. The third interspace has a predigital nerve appearing at the first interphalangeal joint of the fourth finger, and a larger postdigital from the metacarpo-phalangeal joint of the third finger.

The interfemoral membrane shows a distinct pelvo-tibial line and three symmetrical lines from the caudal vertebræ. Two faint lines run down from palm for a centimeter apparently in the position of the fibrous lines which extend from the palm to this membrane in *Molossi*.

The sickle-shaped terminal phalanx of the third finger has a free tip and a cutaneous hem on pollical side.

The terminal phalanx of the fourth finger is small acicular, inclosed and directed dorsal with a slight inclination pollical; that of the fifth finger is about the length of the preceding, is acicular, directed somad, the extreme tip projects, and is free on pollical side.

The distribution of the fur on the interfemoral membrane is of sexual significance. In the female the short hair is sparsely diffused at the base of the tail and along the caudal vertebræ and is absent

from the dorsal space defined on the one side by the femur and proximal half of the tibia and on the other by the pelvo-tibial line. In the male the membrane is generally more hairy and the space defined is covered as is the rest.

Rhinopoma microphyllum.

The endopatagium and mesopatagium with numerous vertically disposed bands extending well up in radiometacarpal angle. Intercosto-humeral line inconspicuous. Internal-cutaneous with two very long slender superior-oblique lines one of which reaches the radiometacarpal angle. Muscle-mass without oblique folds. The fourth interspace with conspicuous predigital nerve which appears at the middle of the fifth metacarpal bone. The postdigitals are four in number,—the lowest is also the largest and appears at the distal fourth of the fourth metacarpal bone. The third interspace with three very small predigitals from the first phalanx of the fourth digit, and a single postdigital from the metacarpo-phalangeal joint of the third. Tips to the terminal digits apparently absent.

The general resemblance of these characters with those of *Taphozous* is striking. The chief contrast is the apparent absence of the postdigitals in the fourth interspace.

Taphozous mauritanus. (?)

Prebrachium with middle crescentic portion as in *Saccopteryx* and a nerve is seen in the membrane near the wrist. The angle of the elbow occupied by a thicker sharply-limited membrane than elsewhere.

Endopatagium with 20 oblique lines of the intercostal series, the lowest not the largest. The intercosto-humeral is axillary, simple, undivided. It reaches the line of the elbow only near the margin of the membrane.

The internal-cutaneous line with three vertical lines from the horizontal portion, four superior oblique lines, the main line ending near the end of the fifth digit. The oblique lines on membrane sixty-seven in number and extend well up towards the radiocarpal angle.

A set of lines distinct from the foregoing occupy the region of the elbow. They are continuous in part with the intercosto-humeral line, and in part are attached to the forearm at the elbow. The mesopatagium near the phalanges of the fifth finger retains a number of delicate lines which appear to be different from those already named.

The radiometacarpal angle occupied by a deep duplicature of

membrane. A small portion of the radial side of the fold attached to a fold lying directly upon the membrane. Extending from the radius at this fold a vertical line is conspicuously seen.

Predigital, one only; it arises high up from the fifth metacarpal bone and extends obliquely across membrane. Postdigital absent.

The postdigital is absent in the third interspace.

Interfemoral membrane with pubotibial line. A vertical line is seen extending entire length of membrane at a point midway between the tail and the leg. The membrane occupied by a set of numerous transverse lines and a second oblique set.

Membranous terminal phalanges apparently absent. The specimen is in bad condition.

Atalapha cinerea.

The prebrachium without details. The lines of the endopatagium are indistinct owing to the hairiness of the membranes. The intercosto-humeral line extends to the free margin as in *Miniopteris* and *Emballonura*.

The internal-cutaneous system crosses the elbow at origin, is without vertical branch, but yields two horizontal primal branches; these extend across the membrane near each other and appear to end in the abruptly determined comb-like endings which do not reach the region of the phalanges of the fifth finger. There are two oblique lines extending downward and somad from the muscle-mass at distal end of the fifth finger.

The fourth interspace has the predigital nerve as in *Miniopteris* while the terminal branches do not reach the digits of the fifth finger but join a branching nerve which appears from the metacarpophalangeal joint of the fourth finger. A small unbranched line (postdigital nerve?) appears at the middle of the fourth metacarpal bone.

Two oblique bands are seen on the fourth interspace near the palm. A fork-like arrangement of lines is seen in the angle between fourth and fifth metacarpal bones and appears to be a branch of the median dividing into the two branches commonly seen in this interspace. In the third interspace a similar arrangement is seen but the main nerve pursues a longer course before dividing. At the region of the digits there are two predigital nerves and three postdigitals. In this portion of the membrane therefore an unusually large number of lines are seen. It is possible some of these lines pertain to the blood vessel system.

The pelvotibial line is not seen on the interfemoral membrane; but the oblique lines from the caudal vertebræ are distinctly visible.

The terminal phalanx of the third finger is curved only at the tip and no part thereof projects; that of the fourth finger is acicular, deflected at a right-angle pollical to the second; it yields a free projecting tip; that of the fifth finger is acicular, is deflected somad and inclosed only on this side.

The membrane of the first interspace can be discerned everywhere along the line of the wing except at part of the first phalanx of the third digit.

Atalapha noveboracensis.

The parts much the same as in *A. cinerea* with the exception of the intercostal lines which are more distinct than in that species and the horizontal limbs of the internal-cutaneous system are farther apart. The third interspace is without predigital lines. The terminal digit of the fourth finger is without projecting lobe; that of the fifth finger is minute.

Lasionycteris noctivagans.

The prebrachium with distinct tendon of occipito-pollical muscle. The external-cutaneous nerve is seen crossing the angle between the arm and forearm near the elbow. Three conspicuous intercostal lines are discerned.

The intercosto-humeral line unites with the internal-cutaneous system. It arises high up near the axilla. The internal-cutaneous system with vertical oblique and horizontal lines discernible. None of the terminal lines of the foregoing, viz., the intercostal intercosto-humeral or internal-cutaneous reach the free margin of the wing-membrane. No vertical lines apart from the foregoing are discernible. The oblique tibial line arises from near ankle and extends as far as the intercosto-humeral at the elbow.

A delicate forked line extends downward and somad from lower part of muscle-mass at the proximal end of the fifth metacarpal bone.

The fourth interspace exhibits the predigital nerve appearing in a well-defined elevated fold of membrane at the side of the muscle-mass just named. The line forms a curve and extends about one-half way down the shaft of the fifth metacarpal bone when it is lost along the line of the shaft. The main branch of the nerve arises from the middle of the curve and passes downward and forward but does not extend beyond the middle of the interspace, nor quite to its

free border. The postdigital arises high in the interspace apparently from the palm, approaches the fourth metacarpal bone at its proximal end but soon leaves it and is distributed to the anterior half of the interspace.

The third interspace shows a delicate line from the first interphalangeal joint of the fourth finger and a second longer one from the metacarpo-phalangeal joint of the third finger.

The interfemoral membrane shows the oblique line above called subtibial but in this form it is caudotibial since it arises from the side of the first caudal vertebrae.

The terminal phalanges much the same as in *Atalapha*. The parts are all delicate; the terminal phalanx of the third digit is sigmoid and less rigid than in any species examined. The tip of the terminal phalanx of the fourth digit is minutely lobed and free.

The markings in *Vesperus*, *Vesperugo*, and *Vespertilio* are among the most intricate of any in the order. My material has not enabled me to do more than give a general idea of the parts. The characters appear to be more sharply defined in *Vespertilio* than in *Vesperus*, and often yield good characters in separating species. As may be expected the American species are the most difficult. I may here mention that owing to the close resemblance in general appearance and similarity of habit of *Vesperugo georgianus* and *Vespertilio subulatus* the two species are frequently found in the same jar and both receive the name of the commoner form, *V. subulatus*. Brief examination is alone required to separate them. The two predigitals and absence of the postdigitals in the fourth interspace of *Vesperugo georgianus* being easily separated from the symmetrical arrangement in *Vespertilio subulatus*.

***Vesperus fuscus*.**

The parts throughout much the same as in *L. noctivagans*. There is a small oblique band at the muscle-mass at proximal end of the fifth metacarpal bone on the mesopatagium and one on the fourth interspace. The intercostal lines five in number. The postdigital as a rule appears as one of two terminal branches which arise from a common trunk in the angle formed by the approximation of the fourth and fifth metacarpal bones. The line may in some instances approach the fourth metacarpal and in some the fifth, when the arrangement resembles that of *Vesperugo georgianus*. The predig-

ital nerve shows the line from the muscle-mass scarcely elevated. The terminal phalanx of the fourth digit L-shape.

Vesperugo georgianus.

Intercostals three in number. Intercosto-humeral from the axilla. The fourth interspace with two long conspicuous predigitalis, but no postdigital. The third interspace with the nerves from the metacarpophalangeal joints. In a few specimens the two postdigitals arise from a common line which extends parallel to the fifth metacarpal bone in which case a close resemblance to some forms of *Vesperus fuscus* is seen. The terminal phalanx of the fourth finger as in *L. noctivagans*.

Vesperus discolor.

Intercostals four; intercosto-humeral at middle of the humerus simple. Internal-cutaneous with two inferior vertical lines. A conspicuous raised oblique line on mesopatagium from the muscle-mass of the fifth digit. A second oblique line (but smaller than the foregoing) on the fourth interspace. The predigital of this interspace appears from the fourth metacarpal bone 2mm. above the metacarpophalangeal joint.

Vesperus noctula.

The prebrachium with ridge over position of thickening on tendon of occipito-pollicalis. The mesopatagium retains an oblique fold from muscle-mass and a second from the same in the fourth interspace. The radiometacarpal region without raised folds from radius. This interspace retains a long predigital from the center, no nerve appearing from the fifth digit itself. The predigital is a small nerve appearing a short distance proximal to the fourth metacarpophalangeal joint.

In *V. lasiopterus*, a closely allied species, the folds from radius near the wrist are raised and the one nearest the wrist conspicuous as in *Nyctinomus* and *Molossus*. The predigital nerve of the fourth interspace showing a disposition as in *V. fuscus*, viz., to divide high up, the main nerve to be a little convex to the line of the digit, and a large branch to arise from this convexity to be distributed to the membrane. The postdigital as in *V. noctula*.

These distinctions of the markings of *V. noctula* and *V. lasiopterus* correlate with others in the auricle, the outer border in the species last named being less well developed. The terminal phalanx of the fourth finger is L-shaped.

Vesperus hesperus.

Intercostals three in number, the lowest appearing at the knee and passing to the free margin of the endopatagium.

Intercosto-humeral appears at the middle of the humerus; it is simple and apparently joins a vertical line which is extended downward from the elbow.

The internal-cutaneous with a single inferior line, but with no superior obliques.

The fourth interspace with digital nerves as in *Vespertilio*, in this regard markedly differing from other examples of *Vesperus* which have been examined.

The interfemoral membrane provided with a pubocalcaneal line.

Scotophilus temminckii.

Prebrachium with ridge appearing on dorsal surface near the radius as in *V. noctula*. The intercostals two in number raised and bold, the lower receives an accession from the region of the knee. The intercosto-humeral unbranched. It appears at the middle third of the humerus. A well-defined oblique tibial line passes upward and outward. The internal-cutaneous nerve is of great simplicity, the superior obliques small, and imperfectly defined, the inferior two in number, bolder. The nerve ends in a linear structure to the side and beyond the terminal phalanx of the fifth digit, as in *V. murinus*. The muscle-mass of this digit with two oblique lines.

The fourth interspace with one oblique line from the muscle-mass. The predigital much the same as in *Vesperugo fuscus*. The main nerve in the angle divides below the oblique line, one branch going to the fifth digit and the other forward and downward obliquely across the interspace. The postdigital is small and appears at the metacarpo-phalangeal joint.

The third interspace with the predigital from the first interphalangeal and the postdigital from the metacarpo-phalangeal joint.

The interfemoral membrane with several caudal lines and one long branched line from pubis which does not, however, reach the tibia.

V. subulatus var. from Mammoth Cave.

The prebrachium as in *Vesperus*. The endopatagium with eight oblique lines extending from the trunk and the leg. These lines are distinct from those described in other species. They pursue a different course, end on the intercosto-humeral system, and appear to be distinct from the nerves of the side of the body and the

posterior extremity. These last named are so faint and indistinct that they cannot be accurately noted. At the knee an oblique band extends outward and downward and intersects the oblique tibial band, which in this genus is of large size and can be traced across the wing membrane almost to the forearm.

The intercostal humeral line arises high up towards the axilla, is slightly curved with the concavity toward the body, and is intimately associated with the oblique lines already described. Beyond these lines and at a point proximal to the elbow, a delicate line extends below this joint where it terminates on a line between the elbow and ankle. The internal cutaneous system arises to inner side of humerus directly proximal to elbow. It soon divides into two branches, the vertical and oblique. Above the oblique is a delicate line in the position of the horizontal of other forms, but it appears to be fibrous only, that is to say is part of the trabecular system and is distinct from the nerve or vessel. This line may receive the name, *paraneural*. A very delicate oblique band is discernible by careful inspection at the muscle-mass at proximal end of the fifth metacarpal bone, extending on the prebrachium.

The fourth interspace exhibits a single nerve in palmar end of space. This soon divides into a predigital and a postdigital. The predigital runs near the fifth metacarpal bone and parallel with it to its middle; it is then deflected obliquely downward and forward to supply more than half of the fourth interspace. The postdigital lies along side of the fourth metacarpal bone as far as the middle and thence is deflected at a more acute angle than the preceding nerve and is distributed to the anterior third about of the interspace. The predigital divides just before reaching the metacarpo-phalangeal joint. The postdigital is seen just above the first interphalangeal joint. The third interspace has a delicate nerve passing downward and forward from the first interphalangeal joint of the fourth finger and a second longer nerve from the metacarpo-phalangeal joint of the third finger.

The terminal phalanx of the third finger of very flexible cartilage, that of the third finger angulated at distal third, but not L-shaped; that of the fifth finger deflected so as to lie its entire length in the free margin of the membrane.

Interfemoral membrane without distinctive lines.

Vespertilio ciliolabrum.

The membranes throughout as in *V. subulatus*.

The terminal phalanx of fifth finger with lobe-like tip and less deflected from line of the second phalanx toward the body.

Vespertilio nigricans.

Presents a thickened fold on the border of the prebrachium. Intercostal lines four in number. Intercosto-humeral rudimentary.

Fourth interspace with two predigital lines. The lower of these is the largest and crosses the fifth digit. A minute fold extends on the mesopatagium at the point of crossing. The postdigital is less oblique than the foregoing.

Vespertilio murinus.

Endopatagium. Intercostal lines three, conspicuous. Intercosto-humeral line undivided. The internal-cutaneous with four inferior vertical lines, none of them crossing the main nerve. The paraneural ones do not reach to within a centimeter of the radius. A conspicuous linear marking ends in a tip along side of the terminal phalanx of the fifth digit and appears to receive some of the endings of the internal-cutaneous.¹ The oblique line from the muscle-mass is inconspicuous.

In the fourth interspace a marked linear fold lies in angle. The oblique fold from muscle-mass well developed. The predigital and postdigitals as in *V. subulatus*, excepting that a separate nerve appears at the metacarpo-phalangeal joint of the fifth finger.

The terminal phalanx of the fourth finger T-shaped; that of the finger is acicular and is enclosed in membrane.

Corynorhinus macrotis.

The markings are of the same general character as in *Vespertilio*.

Nycticejus crepuscularis.

Intercostals four. Intercosto-humeral appears near axilla and becomes vertical a little beyond the elbow. The internal cutaneous with a single superior oblique and a single vertical inferior: The line above the main trend of the nerve as in *V. fuscus*. The fourth

¹ The appearance in *V. murinus* at the region of the mesopatagium along side of the terminal phalanx of the fifth digit is due to a rod of cartilage which resembles in structure that of the terminal phalanx. The details of the disposition of this stylus varies in different forms. It is broad and spatulate in *Vesperugo discolor* but acicular in *Vespertilio mystacinus*. The stylus is constant in many forms, and inconstant in others. It is not separately described in the notes since its nature was not detected until the paper was going through the press.

interspace as in this species except that the postdigital appears at the proximal sixth of the fourth metacarpal bone. In one specimen it was absent. Oblique tibial and pubo-tibial lines as in this species.

Mormoops blainvillei.

Prebrachium with a tendon lying parallel to free margin at middle third. An oblique line extends from the humerus forward and upward.

Intercostals nine in number, reaching side of trunk, the lowest not larger. The intercosto-humeral forked, reaching the line of the elbow; several small branches of this line before division pass obliquely downward. Internal cutaneous passes to the extreme tip of the mesopatagium. The main line horizontal to the middle of the membrane and thence abruptly deflected downward and outward. Two superior obliques, six inferior obliques. A broad raised fold extends obliquely on mesopatagium from the muscle-mass of the fifth digit. The fourth interspace with predigital high up on the fifth digit from the side of the muscle-mass and supplies two-thirds of the membrane, the postdigital arises from near the proximal end of the fourth digit and supplies anterior third.

Interfemoral membrane without pubotibial line. Beyond the point at which the tail emerges a straight line continues to the free margin. Two lines pass from the tail, one obliquely to reach the margin, one transversely to reach the calcaneum near the ankle. Three faintly-expressed lines pass from the thigh and leg downward. Terminal phalanges quite different from *Chilonycteris*, that of the third finger ossified with second digit, the remaining two apparently absent, possibly ossified with the second phalanx of their respective digits.

Chilonycteris davyi.

Prebrachium tendon seen parallel to proximal half but no oblique tendon traverses the membrane from the humerus. Intercostals fourteen and do not reach the body. Intercosto-humeral as in *Mormoops*. The internal cutaneous lines thirteen, six of these are confined beneath the main line and are the same as the inferior verticals of other descriptions in this paper. The succeeding two intersect the main line where it turns from the horizontal to an oblique position. The remaining lines pass up toward the radio-metacarpal angle and are ranged on the trabeculae of the membrane. The tip of the nerve goes to the extreme tip of the fifth

digit. A small oblique fold concealed beneath lateral border of the muscle-mass of the fifth digit.

In the fourth interspace the general arrangement as in *Mormoops*. A faint attempt at the formation of a longitudinal line seen. The postdigital arises from the end of the proximal third of the fourth digit. The predigital and postdigital unite.

The interfemoral membrane as in *Mormoops*, the branches from the thigh and leg inconspicuous or absent.

Tips of digits much as in *Molossi*.

Natalus stramineus. (Plate x, fig. 3.)

Endopatagium with seventeen intercostal lines. Intercosto-humeral attached to proximal third of the humerus; it divides once before reaching line of the elbow whence it passes almost to margin of the membrane.

The internal cutaneous with seven conspicuous vertical inferior lines; one doubtful superior oblique present. Above the main nerve two lines run parallel to it. One of these ends abruptly whence a vertical line extends inferiorly. A rectangular disposition of lines. The second passes to the metacarpo-phalangeal joint.

The fourth interspace with pre- and postdigital nerves symmetrically disposed. Each nerve arises high up on the metacarpal.

The angle of this interspace occupied by a sharply defined fold. An apparent attempt at the formation of a longitudinal line is the third interspace opposite the first phalanges. The terminal phalanges simple small and inconspicuous.

Thyroptera bicolor.

Intercostals five and reach side of trunk. Intercosto-humeral near axilla, simple unbranched. Internal cutaneous without superior oblique. The line is intersected by four verticals, nine toward radiocarpal angle.

A delicate line appears at the radius near the elbow and ends on the mesopatagium near its middle. This appears to be homologous with the line above the internal-cutaneous in *Vespertilio*, *Vesperugo*, etc.

Fourth interspace. Three predigital lines. All are small, the lowest the largest and arises from the digit at distal fifth of fifth metacarpal bone. Near the angle of the interspace but to the side of the fifth digit is a large nerve which appears to be the same as the postdigital, which in place of arising near or at the apex as in

V. fuscus or from the fourth digit, as in many forms belongs actually to the opposed side of the interspace.

The third interspace with a large predigital which arises from the side of the fourth digit half up the side of the metacarpal bone. The post digital is absent.

The interfemoral with numerous transverse lines as in *Vespertilio* and allies. Two lines are attached to the tail, one passing to the ankle and one to the free margin of the membrane as in *Mormoops*.

The terminal cartilages as in *Vespertilio* except in the instance of the fourth finger which is bilobate.

Nycteris sp?

The intercostal nerves are rudimentary and six in number. The intercosto-humeral leaves the arm at the elbow and descends vertically thence. The internal-cutaneous nerve sends a large branch to the fifth metacarpal bone. The predigital nerve of the fourth interspace appears high up near the angle. The postdigital is absent.

The third phalanx of the third finger one-fifth the length of second phalanx. It is deflected somad at the margin. Well-defined membranous phalanges are seen on the fourth and fifth fingers. The fourth terminal phalanx is of cartilaginous consistence.

Megaderma spasma.

Prebrachium with a line on the distal part as in *Pteropus*. One middle conspicuous intercostal, and one lower line (crural). The intercosto-humeral system composed of two lines, which appear at the distal fourth of the humerus but pass scarcely at all beyond the line of the elbow. The internal cutaneous line sends a branch to the fifth metacarpal bone as in *Nycteris*.

The fourth interspace in addition to the predigitals and postdigitals from the metacarpo-phalangeal joints possess a large nerve which arises by two roots from the side of the fifth metacarpal bone

The interfemoral membrane with remarkably distinct pubo-tibial bands. The distal third of membrane much less translucent than the proximal two-thirds. The free margin of the endopatagium often presents a similar appearance. All the terminal digits are well developed, membranous and lie somad in the free margins of the membrane.

The third interspace crossed by a line which unites the metacarpo-phalangeal articulations. A number of symmetrically arranged pigment patches are arranged on either side of this line.

Megaderma frons. (Plate x, fig. 2.)

Prebrachium with a vertical line from the angulated portion of the free margin. Endopatagium with six intercostal lines. Intercosto-humeral composed of two lines at its appearance from the proximal end of the humerus; these unite to form a single line below the elbow. The internal-cutaneous with six inferior vertical lines and an equal number of superior vertical. No superior oblique lines are seen. A separate pannicular line lies beyond the range of the internal-cutaneous. The predigitals of the fourth interspace three in number; all are short,—the most proximal of the three being the longest. The postdigital is small and appears a short distance above the metacarpo-phalangeal joint of the fourth finger. The predigital of the third interspace appears at the metacarpo-phalangeal joint of the fourth digit. The postdigital from the first interphalangeal of the third digit. Two delicate trabeculae extend across the third interspace between the metacarpo-phalangeal of the fourth and the first interphalangeal joint of the third finger.* The inter-femoral membrane shows a short caudal line with a long conspicuous line extending thence to the ankle. The movable tips on ends of osseous phalanges, exceedingly rudimental.

Rhiolophus philippinensis.

The prebrachium without characteristic lines.

The endopatagium with well-marked lines extending from body, thirteen in number, the lowest being the stoutest.

The intercosto-humeral line extends beyond elbow before being deflected downward.

The internal-cutaneous system lies below elbow and yields the oblique line only. This traverses the membrane to the region of the phalanges of the fifth finger. The muscle-mass on the fifth metacarpal bone without oblique lines. Pocket at radiocarpal angle.

In fourth interspace there are two postdigital nerves. One of these appearing at distal third of the fifth metacarpal bone, and one at the metacarpo-phalangeal joint. A single postdigital nerve is seen at the distal fifth of the fourth metacarpal bone. In the third interspace there are two nerves, one appearing from each of the metacarpo-phalangeal joints.

The third phalanx of the third finger small, one-eighth of the length of the second phalanx. The third phalanx of the fourth

* In a second specimen in bad condition, which came to hand while the paper was going through the press, these pigment spots were absent.

finger a mere nodule and deflected somad; that of the fifth finger is absent.

The interfemoral membrane with a conspicuous caudotibial line.

Phyllorhina commersonii.

The intercostal lines rudimentary or absent. The intercosto-humeral line scarcely reaches the line of the elbow. In the fourth interspace there are five predigital lines. The third phalanx of the third finger is small and deflected somad on the free margin of the membrane of the third interspace. The third phalanx of the fifth finger is present and of the same character as in *Rhinolophus philippinensis*. The remaining features as in this species.

Phyllorhina diadema.

Resembles *R. philippinensis*. The intercostal lines are numerous. There is but one predigital nerve in the fourth interspace.

Phyllorhina galerita.

The predigital and the postdigital nerves appear at the middle of their respective metacarpal bones.

Epomophorus franqueti.

The prebrachium shows the tendon of the occipito-pollical muscle to be thread-like and to divide at the wrist into two branches. It lies a short distance below the free margin of the membrane. At the distal third of the forearm an oblique line reaches it from beneath. No lines are raised above the plane of membrane as in other genera of the Pteropidæ.

The intercostal lines small but numerous; not counted. The crural line scarcely larger than the others. The intercosto-humeral line small, rudimentary. The line ends abruptly in an open plesh before reaching the elbow. A coarse network of branches are seen on the line of the elbow. A few branches reach the free margin of the membrane.

The superior oblique line branching off from the internal cutaneous inconspicuous. The main internal cutaneous line reaches the middle of the mesopatagium and is thence abruptly deflected downward and outward and terminates in the neighborhood of the second phalanx of the fifth toe. One branch ends at the metacarpophalangeal joint, and another at the free margin of the membrane. The radio-metacarpal angle is crossed by a membrane.

The predigital nerve appears at the metacarpophalangeal joint of the fifth finger and the postdigital at that of the fourth. Two

tendons cross (beneath the skin) the angle of the fourth interspace. These do not correspond to the raised folds of *Pteropus*. In the third interspace the predigital nerve appears at the fourth metacarpophalangeal joint and extends parallel to the first digit to the first interphalangeal joint. From the middle of this nerve a branch passes obliquely downward and outward. No arrangement similar to this is seen in any other form. In the second interspace with a distinct predigital nerve.

In *Hypsignathus* (dried skin) the predigital is as in *Pteropus*. Thus this genus is distinguished from *Epomophorus franqueti* by a character of the mesopatagium.

***Pteropus vulgaris*.**

The tendon concealed in margin of the prebrachium, and becomes apparent only at the distal fifth of forearm. Two oblique lines pass upward toward the tendon from the line of the forearm.

Endopatagium with a few faintly traced intercostal lines, two of which become fleshy interiorly. These, the crural line and the intercosto-humeral line distinct, raised and unbranched.

The internal cutaneous line with two superior oblique branches. The main line ends at the terminal digit of the fifth finger without division. Six vertical raised lines (and several smaller ones near the fifth finger) cross the membrane.

The fourth interspace with the predigital from metacarpophalangeal joint, and the postdigital from the first phalanx just below the joint. The angle of the interspace crossed by a raised fold. The third interspace with the predigital nerve appearing from the first phalanx of the fourth finger just above the interphalangeal joint. The nerve is curved forward, while the postdigital is straight and appears near the distal end of the first phalanx of the third finger. As with the fourth, the third interspace is crossed by a raised fold. The cruro-tibial fold of the interfemoral membrane raised.

***Pteropus medius*, and *Pteropus* sp?**

The same as *P. vulgaris*. In an embryo the transverse bands were as conspicuous as in *P. vulgaris*.

***Cynonycteris stramineus*.**

One adult and six immature specimens of this species were examined. The lines were much the same as in *P. vulgaris*. In the third interspace the digital lines appeared from the inter-

phalangeal joints, and the fourth interspace not crossed by fold in three. Bands were absent across the interspaces in four. The post-digital line in the fourth interspace from the joint in one.

It will thus be seen that the presence of the raised fold in the angle of the third and fourth interspaces is variable in the young of this species and it may be here regarded as a variable, acquired character. In the embryo of *P. medius*, the fold was present.

The arrangement of the lines on the membranes is sufficiently distinct to distinguish the single example of *Epomophorus* from any of the four species of *Pteropus*. It is evident that in the genus last named the same general characters are declared with a disposition to variation in a few details.

***Cynonycteris collaris*.**

The arrangement of lines much the same as in *Pteropus*. There are six raised intercostal lines present. All the digital lines appear at the joints or the phalanges. The oblique line from the forearm absent in the prebrachium. The raised folds are absent from the angles of the interspaces.

***Cynonycteris ægyptiaca*.**

The intercostal lines are rudimentary or absent. The lower or crural line alone well seen.

***Cynopterus* sp? from Borneo.**

A few rudimental intercostal lines seen which do not join the trunk. A large pelvo-crural raised line is present. The intercosto-humeral line is raised, simple and without division until the border of the free margin of the membrane is reached. The nerve does not extend as far as the line of the elbow. The internal-cutaneous line with three superior branches. Numerous small vertical lines traverse the mesopatagium. The main nerve sends a branch to the metacarpo-phalangeal joint of the fifth finger.

The fourth interspace with digital nerves from the metacarpo-phalangeal joints. The third interspace with the postdigital from distal fourth of the first phalanx.

***Cynopterus* sp? from Borneo.**

No branch is given from the internal-cutaneous nerve to the metacarpo-phalangeal joint. In other respects as in foregoing.

***Cynopterus* sp?**

The intercostal lines join the body, and are raised. The mesopatagium with numerous vertical lines, at least sixteen in number.

In all the Pteropidæ examined the terminal digits are throughout of a simple character. No flexible segments are appended to the osseous ones.

Harpyia major. (Dried skin.)

The intercostal lines confined to one line at the lower part. The line apparently divides at the knee. The intercosto-humeral simple, passes downward as usual on the line from the elbow. The internal-cutaneous with a very short horizontal trend, soon becoming oblique and passing thence to the region of the terminal phalanx of the fifth digit gives one inferior vertical branch, and one superior oblique.

The fourth interspace with the pre- and postdigitals appearing at the metacarpo-phalangeal joints. The third interspace with predigital appearing from the first phalanx of the fourth finger nearly at its middle and with the postdigital from the third metacarpo-phalangeal joint. Owing to the relative shortness of the metacarpals these nerves seem to be unusually long.

Remarks: It may be expected that variations in the arrangements of the wing-markings will be occasionally found. Thus in one specimen of *Saccopteryx leptura* two predigital nerves were found in the fourth interspace on both sides. The additional nerve evidently arose from the main nerve and pursued its course parallel to the fifth metacarpal bone and so close to it as not to appear through the skin-expanse. Each of the large terminal branches in this way arose separately from the side of the bone. In the same specimen the predigital and the postdigital of the third interspace were united by a conspicuous transverse line in the fold of flexion between the phalanges of the third and the fourth digits.

In *Vespertilio subulatus*, the predigital and the postdigital of the fourth interspace were seen extending parallel to the metacarpals some distance before being deflected on the membrane. In other examples they appeared from a loop-like disposition of lines instead of extending directly from the bone. From among numbers of specimens from one locality one of these dispositions prevailed, while examples from a separate locality the other. In one specimen an additional predigital was seen on the left side.

On the whole they may be said to constitute a wider range of variation than in *Vesperus fuscus*. I have had opportunities of examining large numbers of both forms.

In *Vesperus fuscus* (No. 5973 S. I.) the postdigital nerve of the fourth interspace was the same as in *Vespertilio*. This was the only example of important variation which I noted in this common species.

In one example of *Mormoops blainvillei* a supplemental line appeared on the right side between the intercosto-humeral and the internal-cutaneous systems.

The most constant disposition of nerves was seen in the third interspace, and defined the greatest number of groups. The limitation of smaller groups and the place of most decided variation was in the region of the fifth metacarpal bone. The fifth digit was more highly endowed with muscle—indeed was the only digit which exhibited a well-defined muscle-mass at the proximal end. The varying and important raised folds here took their origin, as well as special lines which extended along portions of the entire axis of the digit. The dispositions of some of the interdermal lines in the mesopatagium bordering the digit, especially at and near the radiometacarpal angle, were so variable, that no attempt was made to describe them. It becomes of interest, therefore, to compare this region of the greatest variability with that of the region of the least variability,—the third interspace,—and infer from such data something of the movements of the several parts of the manus in the living individual. The fifth digit would appear to determine more changes, or at least be associated with more changes, than any other portion.

The general arrangement of all parts was much the same in groups already well defined. Thus the Pteropidæ, Nycteridæ, Vespertilionidæ, Phyllostomidæ, etc., each had a distinctive plan. In the group last named all the true leaf-nosed forms agreed in having a longitudinal line in the middle of either the fourth or the third interspaces or in both. The absence of the line in *Mormoops* is suggestive of the false position of this genus in this group, while the general harmony of the details with those of the Emballonouridæ gives us the hint as to what the true position may be. In the genus *Miniopterus* a similar suggestion can be made. *Natalus* and *Thyroptera* already known to be isolated forms remain so from the evidence yielded by the membranes. *Thyroptera* appears to be a highly specialized aberrant Vespertilionid.¹

¹ I have reserved for a separate use descriptions of the markings on the wings of *Molossi*. They differ from those of other groups and are distinctive. The pannicular system here attains the highest development.

EXPLANATION OF PLATE X.

- Fig. 1. The wing membrane in *Phyllostoma hastatum*. Diagrammatic. 1, prebrachium; 2, endopatagium; 3, mesopatagium; 4 ectopatagium (it includes the membrane between *all* the digits); 5, fourth interspace; 6, third interspace. The dotted line extending from the elbow to the free margin of the membrane represents the limit between the endopatagium and the mesopatagium. I, first digit (thumb); II, second digit (index); III, third digit; IV, fourth digit; V, fifth digit (quintus). *a*, intereostals; *b*, intercostohumeral; *c*, internal-eutaneous; *d*, fibrous line appearing at the muscle-mass of the fifth finger; *e*, one of the predigital lines of the fourth interspace; *f*, longitudinal line in the fourth interspace; *g*, one of the postdigital lines of the fourth interspace; *h*, predigital line of the third interspace; *i*, longitudinal line of the third interspace; *j*, postdigital lines of the third interspace.
- Fig. 2. Same, of *Megaderma frons*. A delicate pigmented double contour line is seen crossing the third interspace from the first interphalangeal joint of the third digit to the metacarpo-phalangeal of the fourth digit.
- Fig. 3. Same, of *Natalus stramineus*.